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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/067,429	02/05/2002	Frederik Visser	NL010061	7862

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EXAMINER

FETZNER, TIFFANY A

ART UNIT	PAPER NUMBER
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2859

DATE MAILED: 09/10/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/067,429

Applicant(s)

VISSER ET AL.

Examiner

Tiffany A Fetzner

Art Unit

2859

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on 16 June 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-9 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☐ Claim(s) 1-9 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☒ The proposed drawing correction filed on 16 June 2003 is: a) ☒ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED Final ACTION

1. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Priority

2. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Drawings

3. The proposed red-ink drawing correction to figure 1 of June 16th 2003, which labels Figure 1 as prior art is approved by the examiner

Specification

4. The objections to the disclosure from the May 2nd 2003 office action are rescinded in view of applicant's June 16th 2003 amendment.

Claim Objections

5. **Amended Claim 1**, is objected to because of the following informalities:

Amended claim 1 is an apparatus claim, therefore the word "for" before a phrase following a structural component is interpreted as intended use by the examiner. In

order to positively recite, the amended limitations the word "for" should be replaced by either the word "that" or the word "which". The examiner suggests the following:

- A) In Amended claim 1 line 3 **delete** "for detecting" and **insert either** "that detects" or "which detects".
- B) In Amended claim 1 line 5 **delete** "for receiving and processing" and **insert either** "that receives and processes" or "which receives and processes".
- C) In Amended claim 1 line 6 **delete** "for" and **insert either** "that" or "which".
- D) In Amended claim 1 line 7 **delete** "for combining" and **insert either** "that combines" or "which combines".
- E) In Amended claim 1 line 8 **delete** "for".

6. **Amended Claims 2-8** are objected to because they depend from **Amended claim 1**.

Response to Arguments

7. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., a switching assembly [See page 8 paragraph 2 of the June 13th 2003 amendment response concerning Figure 5 of the Vij et al., reference.]) is not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

8. Applicant's arguments filed June 16th 2003 have been fully considered but they are not persuasive. Figure 5 of **Vij et al.**, shows that the signals from loops 40, 42, 44

Art Unit: 2859

and 46 are separately received.] **Vij et al** teaches the imaging parameters, gradient means, and excitation means of a typical axial imaging sequence generate NMR signals that are detected by the RF coils and recorded as an NMR signal. [See col. 1 lines 13-61].

9. **Vij et al** also teaches and shows "decoupling circuit 64" which is a functional "control unit for selectively routing at least one detected rf signal towards separate receiver channels; combining networks 82, 86 "for combining the RF signals of at least two RF coils" [See Figure 5] depending on the imaging parameters and for applying the combined RF signals to separate receiver channels, such that at least two detected RF signals (i.e. 66, 68; or 62, 70) can be combined to form a combined signal (i.e. 84, or 88) and the combined signal (i.e. 84, or 88) is applied to one particular receiver channel." [See the inputs 88 and 84 which are single channel outputs from the combined channel inputs of combining network 82, 86; that are fed into hybrid combiner 90 to produce final output signal 92]. The examiner also notes that applicant should see Figure 5, decoupling circuit 64, combining networks 82, 86, output signals 84, 88, and hybrid combiner 90, col. 6 line 62 through col. 8 line 63.

10. With respect to applicant's argument that the quadrature signals of Burl et al., are not applied to a single receiver channel. The examiner notes that col. 5 lines 38-40 specifically teach combining quadrature signals as a single channel. Therefore applicant's argument of page 9 paragraph 2 through page 10 paragraph 2 of the June 13th 2003 amendment response is not persuasive.

Art Unit: 2859

11. With respect to applicant's arguments that the dependent claims should be allowed because the independent claim rejections should be withdrawn, [See the June 13th 2003 amendment response page 10 paragraph 3 through page 11 paragraph 2] the examiner is not persuaded, and the original rejections are **maintained**.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. **Amended Claims 1, 7, 9** are **finally** rejected under **35 U.S.C. 102(b)** as being anticipated by **Vij et al.**, US patent 5,370,118.

3. With respect to **Amended Claim 1**, and corresponding **Amended method claim 9, Vij et al.**, teaches and shows "A magnetic resonance imaging apparatus / method comprising: an RF coil system comprising at least two sets of at least two RF coils for detecting RF signals from a region of interest," [See abstract, Figure 5, col. 4 lines 7-25] "at least two receiver channels for receiving and processing the detected RF signals," [See Figure 5, which suggests at least four channels (i.e. 62, 70; 66, 68) "and a "control unit" [See Decoupling circuit 64 taught in col. 7 lines 43-54 to include a diode that may be forward biased by an independent source of DC power to allow a current to flow

Art Unit: 2859

across capacitor 50. Because the conditions of forward biasing control when each of the four coils (i.e. 40, 42, 44, 46) are active, decoupling circuit 64 is a control unit "**for selectively routing at least one detected rf signal towards separate receiver channels**" as amended by applicant. **Vij et al.**, also teaches and shows combining networks 82, 86 "for combining the RF signals of at least two RF coils" [See Figure 5] **depending** on the imaging parameters and for applying the combined RF signals to separate receiver channels, **such that at least two detected RF signals** (i.e. 66, 68; or 62, 70) **can be combined to form a combined signal** (i.e. 84, or 88) **and the combined signal** (i.e. 84, or 88) **is applied to one particular receiver channel.**" [See the inputs 88 and 84 which are single channel outputs from the combined channel inputs of combining network 82, 86; that are fed into hybrid combiner 90 to produce final output signal 92]. The examiner also notes that applicant should see Figure 5, decoupling circuit 64, combining networks 82, 86, output signals 84, 88, and hybrid combiner 90, col. 6 line 62 through col. 8 line 63. [See also the response to arguments given above.]

4. With respect to **Amended Claim 7**, **Vij et al.**, teaches and shows "said control unit is provided to select and/or combine the RF signals of at least two RF coils." [See Figure 5 combining networks 82, 86, and hybrid combiner 90, col. 6 line 62 through col. 8 line 63.] "is provided to select and/or combine the RF signals of at least two RF coils **depending** on the phase encoding direction."

5. **Amended Claims 1-7, 9** are rejected **Finally** under **35 U.S.C. 102(e)** as being anticipated by **Burl et al.**, US patent 6,377,044.

6. With respect to **Amended Claim 1, Burl et al.**, teaches and shows "A magnetic resonance imaging apparatus comprising: an RF coil system comprising at least two sets of at least two RF coils for detecting RF signals from a region of interest," [See Figure 4 where: coils 100₁, 100₂, 100₃, 100₄, comprise a first set of four coils; coils 102₁, 102₂, 102₃, 102₄ comprise a second set of four coils; or coils (100₁, and 102₁), (100₂ and 102₂), (100₃, and 102₃), and (100₄, and 102₄) comprise four sets of two coils as taught in col. 4 lines 24-49] **Burl et al.**, also teaches and shows "at least two receiver channels for receiving and processing the detected RF signals" [See Figures 1 through 4]

7. **Burl et al.**, also teaches and shows "a control unit" [See switch assembly 40; receivers 46, 48 Figures 1-4; the sequence control processor, and teachings of col. 4 line 18 through col. 5 line 49] **for selectively routing at least one detected rf signal towards separate receiver channels** for combining the RF signals of at least two RF coils" [See Figures 1-4] "**depending** on the imaging parameters and for applying the combined RF signals to separate receiver channels, [See col. 4 lines 18-42; and col. 4 line 60 through col. 5 line 5 where the specified imaging parameters, controlled by sequence control processor 50, generate or initiate, the presence or absence of a DC biasing potential that controls the functional mode of the **Burl et al.**, apparatus. The biasing potential is responsible for "applying the selected and/or the combined RF signals to the separate receiver channels, **such that at least two detected RF signals** (i.e. the quadrature and antiquadrature signals) **can be combined to form a combined signal** [See col. 5 lines 20-23] **and the combined signal is applied to one particular receiver channel.**" [See the sequence control processor, and teachings of col. 4 line 18

through col. 5 line 49, especially col. 5 lines 38 to 40 where the quadrature signals of butterfly, loop, ladder (i.e. a planar birdcage coil) are taught to be combined as a single channel and the response to arguments given above.]

8. With respect to **Amended Claim 2, Burl et al.**, teaches and shows "said control unit is provided to combine the RF signals of several groups of at least two RF coils (i.e coils 100₁, 100₂, 100₃, 100₄, comprise a first set of four coils; coils 102₁ 102₂ 102₃ 102₄ comprise a second set of four coils; or coils (100₁, and 102₁), (100₂ and 102₂), (100₃, and 102₃), and (100₄, and 102₄) comprise four sets of two coils as taught in col. 4 lines 24-49], "into a separate receiver channel." [See the sequence control processor, and teachings of col. 4 line 18 through col. 5 line 49]

9. With respect to **Amended Claim 3, Burl et al.**, teaches and shows "said RF coil system (9, 10, 11, 12) comprises two sets of four RF coils." [See Figure 4 where: coils 100₁, 100₂, 100₃, 100₄, comprise a first set of four coils; coils 102₁ 102₂ 102₃ 102₄ comprise a second set of four coils; or coils (100₁, and 102₁), (100₂ and 102₂), (100₃, and 102₃), and (100₄, and 102₄) comprise four sets of two coils as taught in col. 4 lines 24-49]

10. With respect to **Claim 4, Burl et al.**, teaches and shows "a birdcage head coil arrangement." [See col. 3 lines 30 through col. 4 line 17; Figure 1 component 28; col. 1 lines 33-47; and col. 5 lines 41-42 which teaches that the head piece coils, (i.e. the birdcage style head coils shown in Figure 1), can be conveyed to separate receiver channels.]

11. With respect to **Amended Claim 5, Burl et al.**, teaches and shows "said control unit is provided to combine the RF signals of RF coils arranged on opposite sides of the head." [See Figure 1 the sequence control processor component 50, and teachings of col. 3 line 30 through col. 5 line 49]

12. With respect to **Amended Claim 6, Burl et al.**, teaches and shows "said control unit is provided to combine the RF signals of neighboring RF coils." [See Figure 1 the sequence control processor component 50, and teachings of col. 3 line 30 through col. 5 line 49, especially col. 5 lines 23-42]

13. With respect to **Amended Claim 7, Burl et al.**, teaches and shows "said control unit is provided to select and/or combine the RF signals of at least two RF coils **depending** on the phase encoding direction." [See Figures 1, 2, 3, the sequence control processor component 50, and teachings of col. 3 line 30 through col. 5 line 49]

14. With respect to **Amended Claim 9, Burl et al.**, teaches and shows "A magnetic resonance imaging method, comprising the steps of: detecting RF signals from a region of interest while using an RF coil system comprising at least two sets of at least two RF coils", [See Figure 4 where: coils 100₁, 100₂, 100₃, 100₄, comprise a first set of four coils; coils 102₁ 102₂ 102₃ 102₄ comprise a second set of four coils; or coils (100₁, and 102₁), (100₂ and 102₂), (100₃, and 102₃), and (100₄, and 102₄) comprise four sets of two coils as taught in col. 4 lines 24-49] "receiving and processing the detected RF signals while using at least two receiver channels, [See Figures 1 through 4; col. 4 line 18 through col. 5 line 49] "and **selectively routing at least one detected rf signal towards separate receiver channels** for combining the RF signals of at least two RF

Art Unit: 2859

coils" [See Figures 1-4] **depending** on the imaging parameters and for applying the combined RF signals to separate receiver channels, **such that at least two detected RF signals can be combined to form a combined signal (and the combined signal) is applied to one particular receiver channel.**" [See the sequence control processor, and teachings of col. 4 line 18 through col. 5 line 49; and the rejection reasons of amended claim 1 which need not be reiterated.]

Claim Rejections - 35 USC § 103

15. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

16. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

17. **Amended Claim 8** is **finally** rejected under **35 U.S.C. 103(a)** as being unpatentable over **Burl et al.**, US patent 6,377,044 as applied to **Amended claims 1-7**, and **9** above, and further in view of **Pruessmann et al.**, article "SENSE: Sensitivity encoding for Fast MRI" Magnetic Resonance in Medicine 42: pages 952-962 1999.

Art Unit: 2859

18. With respect to **Amended Claim 8, Burl et al.**, teaches and shows "said control unit is provided to select and/or combine the RF signals of at least two RF coils" [See Figures 1 through 4; col. 4 line 18 through col. 5 line 49].

19. **Burl et al.**, lacks directly teaching that the "selection and/or combination of the RF signals of at least two RF coils is depending on the desired SENSE reduction direction." However, SENSE, a conventional MRI multi-coil encoding procedure developed originally by Pruessmann et al., in 1999, is usable with FFE (i.e. fast field echo), TSE (i.e. turbo spin-echo), and half-Fourier EPI (i.e. echo-planar imaging) procedures, [See Pruessmann et al., page 958 col. 2 discussion paragraph] and Burl et al., teaches the use of numerous procedures with the Burl et al., device including: "any of a plurality of magnetic resonance imaging and spectroscopy sequences, such as echo-planar imaging, echo-volume imaging, gradient and spin-echo imaging, fast spin echo imaging and the like." [See **Burl et al.**, col. 4 lines 18-23] Therefore, It would have been obvious to one of ordinary skill in the art, at the time that the invention was made to modify the teaching of **Burl et al.**, to include SENSE MRI techniques because the type of imaging sequences for which SENSE is known to be usable, are producible by Burl et al., apparatus.

20. Additionally, **Pruessmann et al.**, teaches and suggests that in conventional SENSE MRI methodology the reduction factor is bound by the number of coils used. [See page 953 col. 2 the first full paragraph], and that the geometry factor, (i.e. the arrangement of the coils around a patient, such as the arrangements shown on page 957 in Figure 3 of col. 1, and the phantom experiments section of page 957) of SENSE

Art Unit: 2859

methodology allows the coil configuration to be freely optimized with respect to SNR, independently of coil and slice geometry. [See page 960 col. 1 paragraph 1 and page 960 col. 1 conclusion paragraph 1.] This teaching suggests that the used of a SENSE method results in an inherent reduction factor, related to the number of coils used or selected, and that the actual geometrical positioning of the coils is important, and also suggests applicant's limitation that the "selection and/or combination of the RF signals of at least two RF coils is in dependence on the desired SENSE reduction direction." [See **Pruessmann et al.**, RESULTS page 957 col. 1 through page 958 col. 2].

21. It would have been obvious to one of ordinary skill in the art, at the time that the invention was made that the geometrical arrangement of coils in the **Burl et al.**, apparatus would also have a "selection and/or combination of the RF signals of at least two RF coils is in dependence on the desired SENSE reduction direction", when implemented in a SENSE procedure, because the coil arrangements taught in col. 5 lines 23-49 of **Burl et al.**, suggest geometrical arrangements of two, four, or more combined coils based on the geometrical anatomy to be imaged, therefore if the **Burl et al.**, reference was modified to include the teachings of **Pruessmann et al.**, SENSE methodology the limitation of combining signals based on the desired SENSE reduction, for a specific portion of patient anatomy would fall within the scope of the **Burl et al.**, reference.

22. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Art Unit: 2859

A) US patent 6,469,506 B1 which shows multiple sets of two receiver coils in an MRI phased array coil where the signals from one coil or set are combined to form a single output image signal from the array of coils.

23. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

24. A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

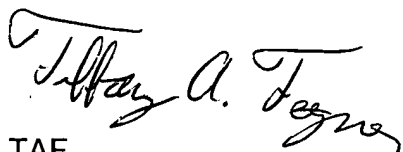
Conclusion

25. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tiffany Fetzner whose telephone number is (703) 305-0430. The examiner can normally be reached on Monday-Thursday from 7:00am to 4:30pm., and on alternate Friday's from 7:00am to 3:30pm.

Art Unit: 2859

26. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Diego Gutierrez, can be reached on (703) 308-3875. The fax phone number for the organization where this application or proceeding is assigned is (703)305-3432 .

27. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-0956.



TAF

August 26, 2003



Diego Gutierrez
Supervisory Patent Examiner
Technology Center 2800